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10/708,375	02/27/2004	Yuan-Chung Lee	MTKP0138USA	2374
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NORTH AMERICA INTELLECTUAL PROPERTY CORPORATION P.O. BOX 506 MERRIFIELD, VA 22116			BLOOM, NATHAN J	
			ART UNIT	PAPER NUMBER
			2624	
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

winstonhsu.uspto@gmail.com
Patent.admin.uspto.Rcv@naipo.com
mis.ap.uspto@naipo.com.tw

Office Action Summary	Application No. 10/708,375	Applicant(s) LEE, YUAN-CHUNG	
	Examiner Nathan Bloom	Art Unit 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 February 2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date: _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date <u>02/27/2004 and 03/19/2004</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

1. Claims 1-5, 10-13 and 20-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bishay (US 6507364) in view of Orlick (US 2003/0098925).

Instant claim 1: A method for controlling an interpolation direction of a pixel needing to be interpolated between a first row and a second row within an image, the image having a plurality of pixels arranged in a matrix format, the method comprising:

(a) calculating a plurality of first horizontal pixel value differences between pixels positioned in the first row and a plurality of second horizontal pixel value differences between pixels positioned in the second row, wherein the first and second horizontal pixel value differences respectively correspond to opposite quadrants of the image with the pixel needing to be interpolated being an origin; and [Bishay: Figures 2-6, Figure 7 as described in column 5 lines 61+ and columns 6-8. Figure 4 is the kernel that performs the horizontal differencing of the 1st and 2nd horizontal rows. However, Bishay in Figure 4 shows that the differencing of the adjacent pixels is performed on both the top and bottom pixels in unison. Orlick in Figure 2A (filters 120A and B) teaches the differencing (measuring edge strength) of horizontal rows of pixels by applying a differencing filter across only a single horizontal row of pixels. Thus providing a

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measure of edge strength for each horizontal row. It would have been obvious to one of ordinary skill in the art to combine the teaching of Orlick and Bishay to increase the accuracy of vertical edge strength determination shown in Bishay.]

(b) comparing the plurality of first horizontal pixel value differences with a first threshold and the plurality of second horizontal pixel value differences with a second threshold to control whether the interpolation direction is orthogonal to the first row and the second row. [*Bishay: Figure 7 and column 5 lines 61+ and columns 6-8 intensity (difference) values are compared to a threshold (assume 1st and 2nd threshold are equal).*]

Instant claim 2: The method of claim 1, wherein step (b) controls whether the interpolation direction is orthogonal to the first row and the second row according to at least one of the following steps (b-1), (b-2), and (b-3): (b-1) if any of the plurality of first horizontal pixel value differences is greater than the first threshold and any of the plurality of second horizontal pixel value differences is greater than the second threshold, controlling the interpolation direction not to be orthogonal to the first and the second rows, otherwise, controlling the interpolation direction to be orthogonal to the first and the second rows;

(b-2) if none of the plurality of first horizontal pixel value differences is greater than the first threshold or none of the plurality of second horizontal pixel value differences is greater than the second threshold, controlling the interpolation direction to be orthogonal to the first and the second rows, otherwise, controlling the interpolation direction not to be orthogonal to the first and the second rows; and

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(b-3) if any of the plurality of first horizontal pixel value differences is greater than the first threshold and any of the plurality of second horizontal pixel value differences is greater than the second threshold, controlling the interpolation direction not to be orthogonal to the first and the second rows, and if none of the plurality of first horizontal pixel value differences is greater than the first threshold or none of the plurality of second horizontal pixel value differences is greater than the second threshold, controlling the interpolation direction to be orthogonal to the first and the second rows. *[Bishay: Figure 7 and column 5 lines 61+ and columns 6-8 intensity (difference) values are compared to a threshold (assume 1st and 2nd threshold are equal). In particular item 44 of Figure 7 states if determined vertical (exceeds set threshold) then perform vertical interpolation and thus an orthogonal interpolation is performed, else non-orthogonal interpolation is performed. Furthermore, methods for non-orthogonal (directional) interpolation were well known to one of ordinary skill in the art.]*

Instant claim 3: The method of claim 1, further comprising: (c) generating the interpolation direction corresponding to the pixel needing to be interpolated according to a directional interpolation process. *[Bishay in combination with Orlick teaches the vertical interpolation of a vertical edge strength exceeds a certain threshold. Furthermore, Bishay teaches performing non-vertical interpolation if threshold is not exceeded. See Figure 7 of Bishay. Furthermore, methods for non-orthogonal (directional) interpolation were well known to one of ordinary skill in the art.]*

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Instant claim 4: The method of claim 1, wherein the first threshold is equal to the second threshold. *[See rejection of instant claim 1]*

Instant claim 5: The method of claim 1, wherein the first row is adjacent to the second row. *[Bishay Figure 2 and 120A and B of Orlick Figure 2A]*

Instant claim 10: The method of claim 1, wherein step (a) calculates the first horizontal pixel value differences through a repeated use of pixel with other pixels positioned in the first row. *[As can be seen in Bishay Figure 2 and 120A and B of Orlick Figure 2A the repeated differencing of pixels has been taught (multiple differences are performed by filter shown when applied to horizontal row of pixels).]*

Instant claim 11: The method of claim 1, wherein step (a) calculates the second horizontal pixel value differences through a repeated use of pixel with other pixels positioned at the second row. *[As can be seen in Bishay Figure 2 and 120A and B of Orlick Figure 2A the repeated differencing of pixels has been taught (multiple differences are performed by filter shown when applied to horizontal row of pixels).]*

Instant claim 12: The method of claim 1, wherein step (a) calculates each of the second horizontal pixel value differences from adjacent pixels. *[Bishay Figure 2 and 120A and B of Orlick Figure 2A. As per rejection of instant claim 1 the combination of these would have been obvious to one of ordinary skill in the art.]*

Instant claim 13: The method of claim 1, wherein step (a) calculates each of the first horizontal pixel value differences from adjacent pixels, and calculates each of the second horizontal pixel value differences from adjacent pixels. [*Bishay Figure 2 and 120A and B of Orlick Figure 2A. As per rejection of instant claim 1 the combination of these would have been obvious to one of ordinary skill in the art.*]

Instant claim 14 describes the device that implements the method of claim 1. *As per rejection of instant claim 1 Bishay in view of Orlick discloses the method. Bishay column 7 lines 60+, and column 8 lines 1-5 as well as claims 1-8 and 17-22 of Bishay show the method implemented in hardware and software. Orlick paragraphs 0036-0041 and 0063 describe various software and hardware elements. Orlick does not go into great detail on the hardware implementation and Bishay describes hardware/software as being implemented in an imaging device. Examiner takes official Notice that software that can be implemented in an imaging device can also be implemented in a personal computer or other known computing devices. Therefore, it would have been obvious to one of ordinary skill in the art to implement the method in a known and appropriate hardware/software product.*

Instant claim 15 describes the device that implements the method of claim 2. *As per rejection of instant claims 2 and 14 Bishay in view of Orlick teaches the device of claim 15.*

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Instant claim 16 describes the device that implements the method of claim 3. *As per rejection of instant claims 3 and 14 Bishay in view of Orlick teaches the device of claim 15.*

Instant claim 17: The device of claim 16, wherein the arithmetic unit and/or the processing unit are installed in the directional interpolation unit. *[As per rejection of instant claims 1 and 14 Bishay in view of Orlick teaches the device of claim 17. Note: A personal computer will perform all the processing in the CPU thus the AU, PU, and DIU are all performed by the same unit.]*

Instant claim 18: The device of claim 14, wherein the arithmetic unit and the processing unit are integrated into one module. *[As per rejection of instant claims 1 and 14 Bishay in view of Orlick teaches the device of claim 18. Note: A personal computer will perform all the processing in the CPU thus the AU, PU, and DIU are all performed by the same unit.]*

Instant claim 20: A method for determining an interpolation direction of a designated pixel located between a first row of horizontal pixels and a second row of horizontal pixels within an image, the method comprising:

- (a) obtaining first values representing differences between pairs of at least some of the first row of horizontal pixels, and obtaining second values representing differences between pairs of at least some of the second row of horizontal pixels; and
- (b) comparing the first values with a first threshold and the second values with a second threshold to determine whether the interpolation direction is orthogonal to the first row and the second row. *[See rejection of instant claim 1]*

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Instant claim 21: The method of claim 20, wherein the first values are obtained by calculating luminance or chrominance values of the first and second rows of horizontal pixels. [In Bishay column 4 lines 10-54 the use of RGB values, wherein each color field is performed on separately, but Bishay does not each performing this operation in either the luminance or chrominance space. Examiner takes Official Notice that it would have been notoriously obvious to one of ordinary skill in the art to use the method taught by Bishay in any known color space, because each of the known color spaces are related in known mathematical ways and it is a simple matter to convert from one color space to another.]

Instant claim 22: The method of claim 20, wherein step (b) determine whether the interpolation direction is orthogonal to the first row and the second row according to at least one of the following steps (b-1), (b-2), and (b-3):

(b-1) if any of the first values is greater than the first threshold and any of the second values is greater than the second threshold, controlling the interpolation direction not to be orthogonal to the first and the second rows, otherwise, controlling the interpolation direction to be orthogonal to the first and the second rows;

(b-2) if none of the first values is greater than the first threshold or none of the second values is greater than the second threshold, controlling the interpolation direction to be orthogonal to the first and the second rows, otherwise, controlling the interpolation direction not to be orthogonal to the first and the second rows; and

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(b-3) if any of the first values is greater than the first threshold and any of the second values is greater than the second threshold, controlling the interpolation direction not to be orthogonal to the first and the second rows, and if none of the first values is greater than the first threshold or none of the second values is greater than the second threshold, controlling the interpolation direction to be orthogonal to the first and the second rows. [*See rejection of instant claim 2*]

2. Claims 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bishay in view of Orlick in further view of Minami (US 2004/0246546).

Instant claim 6: The method of claim 5, wherein: step (a) further comprises calculating a plurality of third horizontal pixel value differences between pixels positioned in a third row and a plurality of fourth horizontal pixel value differences between pixels positioned in a fourth row, wherein the third and fourth horizontal pixel value differences respectively correspond to opposite quadrants of the image with the pixel needing to be interpolated being the origin; and step (b) further comprises comparing the plurality of third horizontal pixel value differences with a third threshold and the plurality of fourth horizontal pixel value differences with a fourth threshold to control whether the interpolation direction is orthogonal to the first, second, third, and fourth rows. [As per rejection of instant claims 1 and 5, Bishay teaches the differencing of neighboring pixels and comparing these differences to a threshold. However, Bishay does not teach the use of a third and fourth row in the calculations. Minami in figures 2-7 teaches a de-interlacing technique in which 4 consecutive horizontal rows are used in the determination and interpolation of the pixel to be interpolated. Given that both are teaching interpolation methods,

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it would have been obvious to one of ordinary skill in the art to combine Minami with Bishay to increase the data used for interpolation and thus improve the accuracy of the interpolation technique taught by Bishay.]

Instant claim 7: The method of claim 6, wherein the first and second rows are positioned between the third and fourth rows. [*See Figure 2-7 of Minami*]

Instant claim 8: The method of claim 7, wherein the first, second, third, and fourth rows correspond to four successive rows. [*See Figures 2-7 of Minami*]

Instant claim 9: The method of claim 1, wherein: step (a) further comprises calculating a plurality of third horizontal pixel value differences between pixels positioned in a third row and a plurality of fourth horizontal pixel value differences between pixels positioned in a fourth row, wherein the third and fourth horizontal pixel value differences respectively correspond to opposite quadrants of the image with the pixel needing to be interpolated being the origin; and step (b) further comprises comparing the plurality of third horizontal pixel value differences with a third threshold and the plurality of fourth horizontal pixel value differences with a fourth threshold to control whether the interpolation direction is orthogonal to the first, second, third, and fourth rows. [*See rejection of instant claim 6 and Figures 2-7 Minami*]

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Instant claim 19 describes the device that implements the method of claim 6. *As per the rejection of instant claims 6 and 14 the device has been taught by Bishay in view Orlick and Minami.*

Conclusion

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

- Greggain (US 5991463) – directional interpolation.
- Acharya (US 6229578) – interpolation based on edge gradients and thresholds.
- Winger (US 2005/0134730) – de-interlacing with vertical edge detection.
- Minami (US 2004/0246546) – directional (orthogonal and non-orthogonal) interpolation.

Contact Information

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nathan Bloom whose telephone number is 571-272-9321. The examiner can normally be reached on Monday through Friday from 8:30 am to 5:00 pm (EST).

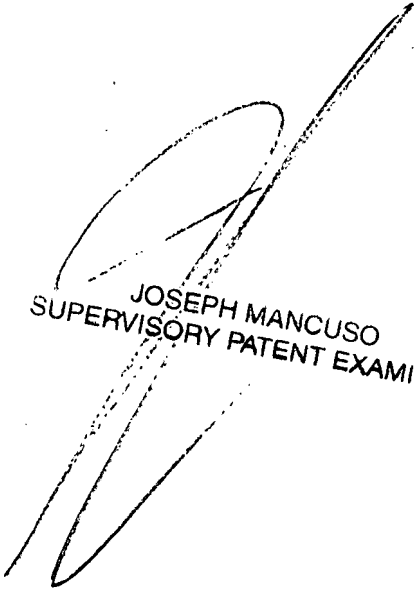
If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Mancuso, can be reached on 571-272-7695. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications

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may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Nathan Bloom



JOSEPH MANCUSO
SUPERVISORY PATENT EXAMINER